

## **Confirmatory Factor Analysis of TQM Implementation Constructs: Evidence from Nepalese Manufacturing Industries**

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### **ABSTRACT**

*Total Quality Management (TQM) is deliberate as an important management philosophy, which has provisions to support the organization to get satisfied customers. The precise implementation of TQM only can enhance success of any organization. There exists extensive research which use diverse key constructs of TQM implementation. The purpose of this study is to identify and make confirmation of key factors of TQM implementation. This study identifies nine key factors of TQM implementation from the extent literature which can help industry to achieve business excellence. The those nine TQM implementation key factors were Top management commitment & involvement, Policy deployment, process control and improvement, Research and development, training and education, maintaining suppliers' empowerment and relationship, customer relationship, employee empowerment and involvement, evaluation and assessment, whereas these key factors again confirmed by*

*assigning the items within the factors with the help of confirmatory factor analysis (CFA).*

**Key Words:** Total Quality management, Organization, customer satisfaction, top management, customer relation, continuous improvement, employee empowerment, suppliers' empowerment

## INTRODUCTION

Since last decades, quality management has been used widely irrespective of size of organization and is consider as the major component of competitiveness and long term success of organization. The successful implementation of TQM in manufacturing sector would promote exports, attract foreign direct investment, improve business performance, achieve a competitive advantage, and customer and staff satisfaction (Magd, 2014). Ensuring TQM and optimum utilization of Human Resource is very much essential to gain sustainability of organization. (Rashid, Taib, & Ahmad, 2016) These benefits are important for all organizations, especially in developing countries, such as Nepal, where the general quality level is relatively low and need to be increased in the chase of effective inter-organizational cooperation. However there exist large number of examples of failed or poorly performed implementation process of TQM. During the process of implementation, organization has to face different complications and often fails to get benefits from quality management implementation. However employee look forward to various development and learning programs and plans available to them to grow not only professionally but only personally (Arora, 2016) Fotopoulus et al. (2009) and Kumar et al. (2009) discussed the impact of TQM practices on quality management results and explains the relationship between different TQM practices like

leadership, strategic quality planning, employee management & involvement, supplier management, customer focus, process management, continuous improvements and their effect on quality management results in the form of market benefits like increase in profits, improved competitive position, improved performance and increased sales. While customer satisfaction is measured by decline in customer complaints, increase in loyalty, and customer retention rate. The strategic alliances result in superior performance of the organizations (Ouedraogo, 2016).

This study focuses to obtain knowledge of total quality management implementation in a unique, and influencing, organizational environment and situation. The study is focused on obtaining key factors of quality management implementation and is expected to provide new insights into the implementation process in order to improve organizations ability to meet their objectives. There is a consensus that TQM is a way of managing an organization to improve its overall effectiveness and performance (Zhang et al, 2000). No uniform view of TQM exists today. So far, TQM has come to mean different things to different people (Hackman & Oldham, 1995). This study aimed at identifying TQM implementation constructs, developing an instrument for measuring these constructs

## **REVIEW OF LITERATURE**

Deming is considered the founding father of the TQM and is perhaps the most famous of quality gurus because of his contribution to the creation of quality principles. Deming has focused on the following four points i) idea of internal and external customers or stakeholder satisfaction ii) concept of continuous improvement iii) thought of common and special variation on quality problem iv) management and worker's responsibilities.

Deming believes in continuous improvement. He also believes that the consumer is the most important part of a production line. Meeting and exceeding the customers' requirements is the task that everyone within the organization needs to accomplish with total commitment. Furthermore, Deming believes in the use of statistical process control (SPC) charts as major method for solving problems. Like Deming, Juran worked extensively with quality management and perhaps he has best summed up in his 'quality trilogy' of quality planning, quality control and quality improvement (Juran & Gryna, 1993). Juran's emphasis in this respect is in three main areas: changing management behavior through adopting quality, training and then spilling down new attitudes to supporting management. Juran has focused on responsibilities, training, education and reward and encouragement for quality.

Crosby suggests for the continual measurement to determine conformance to requirements. He also focused on the cost of quality which is measurable and is equal to the expense of nonconformance- the cost of doing things wrong. Crosby's quality philosophy is that there is an economics of quality. It is always cheaper to do it right first time (Crosby, 1979). He is a concept developer of Zero Defect program. Crosby has given emphasis on management and has stated that management leads workers to a quality outcome. Perfection is the standard to aim for through planning, process and continuous improvement. Kaoru Ishikawa helped thousands of companies including IBM, Bridgestone and Komatsu to turn out higher quality products at much lower costs. His book "What is Total Quality Control?" The Japanese Way, Prentice Hall, Inc. was a best seller business books (Pradhan, 2014). Ishikawa has developed cause and effect diagram (also called the "Ishikawa" or "fishbone" diagram) with which management leader made significant and specific advancements in

quality improvement. Ishikawa also showed the importance of the seven quality tools: control chart, run chart, histogram, scatter diagram, Pareto chart, run chart and flowchart. Additionally, Ishikawa explored the concept of quality circles, a Japanese philosophy which he drew from obscurity into world wide acceptance. Feigenbaum is best known for originating the concept of Total Quality Control (TQC). He viewed quality as a strategic business tool that requires involvement from everyone in the organization and promoted the use of quality measurement and evaluated tool. Feigenbaum has focused on quality leadership, Modern quality technology and Organizational commitment. The concept of “Total Quality Control” was used as the foundation by Japanese for their practice called Company-Wide Quality Control (CWQC) which began in 1960s.

### **Review of Empirical Research**

After Garvin (1983) published the first empirical investigation of quality management factors, there has been found substantial empirical research of TQM implementation till the date and this study has selected few but mostly cited, chronologically ordered researches which is discussed below. Garvin has studied nine US and seven Japanese window air conditioner manufacturing industries. Garvin used self-report questionnaires and on-site observations. Garvin has included: quality programmes, policies, and management attitudes; quality information systems; product design; production and employee policies; and supplier management as constructs of TQM implementation. Saraph et al. (1989) has done first empirical study to validate the factors affecting the quality management using factor analysis. The following eight factors: role of management leadership and quality policy; Role of the quality department; Product/service design; Process management; Supplier quality management; Quality data

and reporting; Employee relationships; and Training, were determined using 120 items under study. In Indian context Motwani et al (1994) has done empirical research where they had identified following nine key factors of TQM implementation: Top management; Quality policies; role of the quality department; Training; Product design; Vendor quality management; Process design; Quality data; Feedback and employee relations. Flynn et. Al. (1995) has used ten construct of TQM implementation constructs and tested using multiple regression analysis after determining the path analysis. The ten construct they used were: Top management support; Customer relationship; Supplier relationship; Workforce management; Work attitudes; Product design process; Process flow management; Statistical control feedback; External quality performance; Competitive advantage. Ahire et al (1996) had studied 371 manufacturing firm to develop and teste 12 constructs integrated TQM implementation. The twelve constructs were as follows: top management commitment, customer focus, suppliers' quality management, design quality management, benchmarking, spc usage, internal quality information usage, employee empowerment, employee involvement, employee training, product quality, and suppliers' performance. Black and Porter (1996) had identified ten critical components of TQM, which are: supplier partnership, people and customer management, customer satisfaction orientation, external interface management, communication of improvement information, strategic quality management, operational quality planning, quality improvement measurement systems, teamwork structure for improvement, and corporate quality culture.

Zhang et al. (2000) had studied 212 Chinese manufacturing companies to identify the eleven construct of TQM implementation which were: leadership, education and training, employee participation, supplier quality management, product design,

process control and improvement, customer focus, vision and plan statement, evaluation, quality system improvement, and recognition and reward. In the same way Conca et al. (2004) empirically tested the following ten success factors of TQM implementation leadership, training, specialist training, supplier management, process management, customer focus, learning, continuous improvement, quality planning, and communication through 108 ISO certified firms in Spain. Projogo and Sohal (2004) has used the following nine TQM implementation constructs leadership, strategic planning, customer focus, information and analysis, people management, process management, product quality, product innovation, and process innovation, where they used the empirical data were obtained from a survey of 194 managers in Australian industry from both manufacturing and non manufacturing firms.

Sila and Ebrahimpour (2005) has used the TQM factors as leadership, strategic planning, customer focus, information and analysis, human resource management, process management, supplier management. Lin et al. (2005) conducted a comparative study between Taiwan and Hong Kong Manufacturing companies. They had used the following constructs: top management leadership, training, product/service design, supplier quality management, process management, quality data reporting, employee relations, customer relations, benchmarking, learning, supplier participation, suppliers selection, satisfaction level and business results. Tari (2005) studied 106 ISO 9000 certified firms of Spain to identify the components of TQM implementation. The total construct used were divided into factor oriented and result oriented constructs. The factor oriented construct were customer focus, process management, leadership, suppliers management, learning, quality planning, continuous improvement, and employee management. Similarly the result oriented constructs

were customer satisfaction, staff indicators, quality performance, social impact and employee satisfaction.

Yang (2006) determines the following TQM practices: process management, employee empowerment and teamwork, customer satisfaction management, quality goal setting and measurement, supplier's cooperation and quality tools training. Jitpaiboon and Rao (2007) used the meta-analysis approach to identify the TQM construct where these construct were top management support, strategic quality performance, supplier quality, benchmarking, employee training, customer focus, employee involvement. Das et al. (2008) has identified the constructs of TQM implementation from ISO certified manufacturing companies of Thailand where they used nine constructs which were top management commitment, supplier quality management, continuous quality improvement, product innovation, benchmarking, employee involvement, reward and recognition, education and training, and customer focus. Arumugam et al. (2008) explored the relationship between TQM practice and quality performance with special emphasis on ISO 9001:2000 certified manufacturing organizations in Malaysia. The findings revealed that total quality management practice were found partially correlated with quality performance. It is also found that customer focus and continual improvement were perceived as dominant TQM practice in quality performance. The construct they had used as a TQM practice were leadership, process management, information analysis, customer focus, supplier relationship, quality system improvement, continual improvement and people involvement. Fotopoulos et al. (2009), surveyed 370 Greek companies to determine the relationships between the TQM factors and organizational performance. They found that leadership, process management, service design, human resource management, customer focus, education and training, and supplier quality management are critical success



factors in TQM implementation. They applied questionnaire method and used exploratory and confirmatory factor analysis to assess the measurement model reliability and validity. The relationships between the latent constructs were examined through Structural Equation Modeling. Kumar et al. (2009) studied the various factors important for total quality management implementation and its relevance in various manufacturing organizations in the context of Indian manufacturing organizations. They had collected 75 questionnaires from various sectors such as automobile engineering, textile engineering, electrical and electronics engineering, light weight engineering and heavy weight engineering from India. The different factors used in their study were customers satisfaction, management effective participation, employee effective participation, reward schemes, communication system, vendor power, statistical quality control, fast result techniques, quality planning and cost involved and analytical techniques.

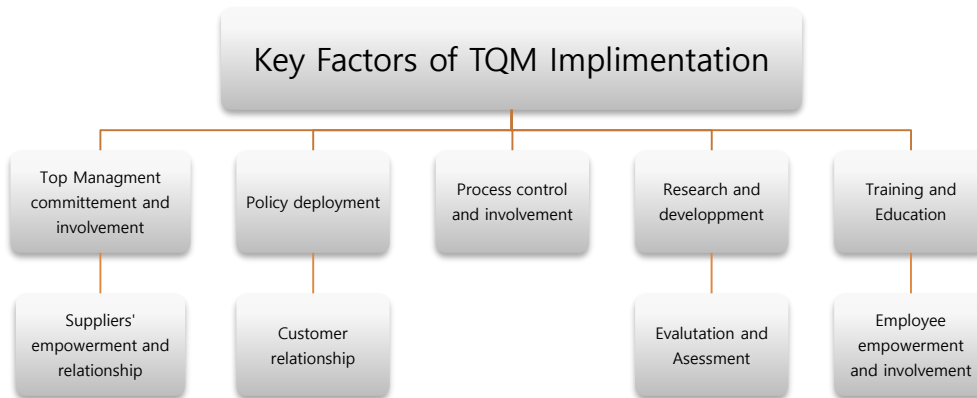
Zakuan et al. (2010) investigated the relationship between TQM implementation and organizational performance using structured equation modeling. They had studies the quality performance of SMEs in the Portuguese organizations. The constructs they had used were quality leadership, customer focus and satisfaction, quality information and analysis, human resource development, strategic planning management, suppliers quality management, quality results, quality assurance, satisfaction level, customer and employee, business result, productivity, number of successful new product, cost performance and profitability. Hoang et al. (2010) studied 222 manufacturing and service companies and used structural equation modeling to study the relationship between implementation of TQM and organizational characteristics in a newly industrialized country in South East Asia. They found that larger companies had higher

implementation level across almost all practice of TQM. TQM practices were statistically more significant in Manufacturing companies compared to service companies and the firms having higher level of innovation also showed higher level of TQM practice implementation. The constructs used by Hoang et al (2010) were as follows: top management commitment, employee involvement, employee empowerment, education and training, teamwork, customer focus, process management, information and analysis system, strategic planning, open organization, and service culture.

Valmohammadi (2011) used seven TQM implementation constructs namely leadership, process management, suppliers, customer focus, employee management, communication and quality information system and tools & techniques from Iranian manufacturing SMEs. Phan et al. (2011) has done empirical study on Japanese manufacturing companies and used the eleven quality management practice constructs to determine the degree of TQM implementation which were top management leadership, formal strategic planning, training, small group problem solving, employees suggestions, cross functional product design, house keeping, process control, information feedback, customer involvement, supplier quality involvement. Bhari et al. (2012) has used structural equation modeling and confirmatory factor analysis to validate eleven constructs of TQM implementation which were leadership, suppliers quality management, vision plan statement, evaluation, process control improvements, product design, quality system improvements, employee participation, recognition and reward, education and training, and customer focus. Munizu (2013) has done empirical study of fifty five big and small scale fishery industry and used path analysis to identify TQM implementation constructs which included leadership, strategic planning, customer focus, information & analysis, people management, process management, and suppliers management.

### Key factors of TQM implementation

In this study, to identify the key factors of TQM two category of TQM construct has been used. They are concept of quality gurus and empirical research findings. TQM concept covers a broader scope of its implementation constructs. From above literature review most repeated nine constructs were taken for further analysis. They were top commitment & involvement, policy deployment with process control and improvement, research and development, training and education, maintaining suppliers' empowerment and relationship, customer relationship, employee empowerment and involvement, and evaluation and assessment. The construct are shown in the following figure 1.



**Figure 1. Conceptual Model of Key Factors of TQM Implimentation**

Source: Kothari, Shrimali and Pradhan (2017)

## **METHODOLOGY AND RESULTS**

In this research the nine TQM implementation constructs were operationalized after extensive review of literature and the instrument were send to evaluate by academicians and practitioners. A set of questionnaire having 68 items associated with nine constructs was developed on the basis of some already tested questionnaire of the past researches. Using judgmental sampling technique, 150 questionnaire were distributed to the industries of Nepal who has implemented TQM as a whole or in a part. Among the 110 returned questionnaire, 7 responses were discarded because 4 of them has partially answered (some of the answers or some demographic variables were left) and 3 of them were response bias (same answer to each of the likert scale). Therefore the final response rate becomes 68.66%. The main aim of the research to confirm the key constructs of TQM implementation, so reliability, item analysis and construct validity had checked using cronbatch's alpha, correlation matrix and confirmatory factor analysis (CFA)

### **Reliability and Item analysis**

There were 9 constructs of TQM implementation and for each construct scale has created with different items. Then reliability measures were performed for items of each scale. The table 1 shows the cronbatch's alpha for different TQM implementation scales. This table shows that the scales which were constructed are reliable ones, except in case of research and development construct whose value is less than the cutoff range. As we know that, reliability coefficients of 0.70 or more are considered good.

**Table 1: Reliability Analysis of TQM implementation**

SN	Scales	Number of items	Cronbatch's alpha
1	Top Management Commitment and involvement	9	0.874
2	Policy Deployment	9	0.842
3	Suppliers' empowerment and relationship	5	0.800
4	Process Control and improvement	10	0.795
5	Evaluation and Assessment	10	0.885
6	Employee Empowerment and Involvement	7	0.817
7	Research and Development	6	0.619
8	Customer Relationship	7	0.771
9	Training and Education	5	0.805
Total items		68	

**Item Analysis of TQM implementation**

Table 2 elaborates the correlation of the nine scales of measurement with their corresponding measurement scales. The corresponding measurement scales were the average of each constructs. The table shows that all values of item to scale correlation were greater than 0.50 except one item in the top management commitment and involvement. These correlations are significant on both 0.5 and 0.01 level. Since all the items were highly correlated with the measurement scale, it is concluded that all the items has been appropriately assigned into the scale.

In this study constructs TQM implementation developed with 68 items. These instruments were made based on the different review and researches (theories and empirical study), so the loadings of the items on the constructs should be checked.

**Table 2. Item to scale correlation matrix (pearson's correlations)**

Scales	Item Number									
	1	2	3	4	5	6	7	8	9	10
Top mgt com. and involvement	.408**	.671**	.746**	.723**	.736**	.729**	.749**	.781**	.745**	--
Policy deployment	.647**	.662**	.720**	.684**	.710**	.577**	.671**	.702**	.617**	--
Suppliers' emp and relationship	.716**	.739**	.805**	.726**	.681**	--	--	--	--	--
Process control and improvement	.616**	.593**	.644**	.648**	.566**	.566**	.653**	.537**	.584**	.534**
Evaluation and assessment	.627**	.743**	.757**	.798**	.664**	.647**	.633**	.725**	.773**	.697**
Employee power and involvement	.676**	.778**	.758**	.657**	.660**	.667**	.642**	--	--	--
Research and development	.608**	.571**	.632**	.585**	.585**	.543**	--	--	--	--
Customer relationship	.640**	.657**	.710**	.629**	.619**	.767**	.555**	--	--	--
Training and education	.754**	.722**	.725**	.795**	.752**	--	--	--	--	--

So, confirmatory factor analysis is appropriate for testing the construct validity in this research. For this purpose path diagram was constructed and factor loading was tested in AMOS 20 using different absolute, incremental and parsimonious fit indices.

### **Construct Validity using Confirmatory Factor Analysis**

Since the construct were prepared on the basis of different review, and empirical research confirmatory factor analysis was used to check the validity of the construct identified. Factor loading of the item was checked using different absolute, incremental and parsimonious fit indices using path diagram in AMOS 20. Modification of the construct had done if the analysis showed any requirements. Maximum Likelihood estimate is used since it is efficient estimator and provides most reliable estimates. The

common measures to judge the goodness of fit chi square ( $\chi^2/df$ ), IFI, TLI CFI and RMSEA were used in this study.

**Table 3. CFA of Top Management Commitment and involvement**

Item	Description	Initial	Final		
		MLE	MLE	Load	
1	Participation in the quality management programs.	0.33			
2	Communication to the employees about policy.	0.61			
3	Encourages employee to involve in quality management and improvement activities.	0.68	0.62	0.11	
4	Learning quality related concepts and skills.	0.65			
5	Arrangement of enough resources for education and training.	0.70	0.70	0.15	
6	Focuses on product quality rather than yields.	0.69	0.68	0.13	
7	Communication and links established with employee	0.72	0.75	0.19	
8	Permits employees to solve quality problems.	0.77	0.82	0.27	
9	Regularities of top management quality audit	0.72	0.73	0.19	
Obtained Fit					
Indices	$\chi^2/df$	RMSEA	IFI	TLI	CFI
Initial	2.086	.103	.919	.890	.917
Final	1.804	.089	.971	.951	.971

Of these nine items, item 1 was showing very low MLE (0.33) and items 2 and 4 were showing comparatively low MLE. Top management's communication skill and their knowledge is questionable mark during this study. Where the factor weights for

these three items were respectively .05, .10 and .10 which is comparatively low than other factor loading.

Table 4. CFA of Policy Deployment

Item	Description	Initial	Final		
		MLE	MLE	Load	
1	Having clear long-term vision statement.	0.58	0.57	.09	
2	The vision effectiveness to encourage employees' commitment.	0.61	0.60	.09	
3	Having clear short term business performance plan.	0.68	0.71	.13	
4	Having a clear quality policy.	0.65	0.71	.12	
5	Having a detailed quality goal.	0.68	0.67	.13	
6	Having effective quality improvement plans.	0.50			
7	Communication about policies and plans to the employees.	0.61	0.57	.08	
8	Employee's involvement in making policies and plans.	0.64	0.61	.09	
9	Use of PDCA while making policy	0.54			
Obtained Fit					
Indices	$\chi^2/df$	RMSEA	IFI	TLI	CFI
Initial	1.927	.095	.908	.873	.905
Final	1.592	.076	.959	.937	.958

Although these items are important in this construct, were deleted for getting overall measurement fit. Although the modified measure gave a speck more RMSEA other indices are reasonably good. So the construct Top management commitment and involvement retains only six items. Of these nine items, item 6 and 9 had low MLE as compare to others. It indicates that companies are week in planning phase and the use of PDCA cycle to make the



plan & policies. The factor weights for these two items were respectively low (0.059 and 0.068). After deleting these two items the construct gave the very well fit indices values (sound over the acceptable level). Researcher supposed that the deletion of these two item in the policy deployment and measure with seven items remains does not violet the content validity of the measurement.

Table 5. CFA of supplier’s empowerment

Item	Description	Initial		Final	
		MLE	MLE	MLE	Load
1	Company focus on product quality while selecting suppliers	0.64	0.63		.10
2	Selection of suppliers on the basis of quality materials.	0.76	0.75		.17
3	Relationship with suppliers for long term partnership and improvement	0.78	0.82		.18
4	Recording detailed information about suppliers’ performance	0.62	0.59		.09
5	Conducting regularly suppliers’ quality audit	0.53			.07
Obtained Fit					
Indices	$\chi^2/df$	RMSEA	IFI	TLI	CFI
Initial	4.443	0.184	.893	.779	.890
Final	5.505	0.210	.929	.78	.927

Five items were used to measure the supplier’s empowerment and the analysis shows  $\chi^2/df$  (4.43), which is more than the accepted limit. But the item analysis shows the correlation of each items with the aggregate score is more than 0.681 (see table no 2). After deleting item no. 5 although IFI (0.929), CFI (0.927) are good enough but other indices does not shows the goodness of fit. Observing the sensitivity of the question quality audit (item 5) researcher decided not to exclude the item from measurement,

keeping in the mind it may shows the problem on content validity of the measurement. All the five measures of suppliers empowerment originally constructed measure were taken for further analysis.

Table 6. CFA of Process control and improvement

Item	Description	Initial		Final	
		MLE	MLE	MLE	Load
1	Existence of quality steering committee.	.54			.06
2	Availability of clearly stated working instructions	.52			.06
3	Having well-organized and perfect database	.59			.07
4	Having plan of inspections effectively in all levels (incoming, process and final product)	.62			.10
5	The intend of evaluating employee performance is for improvement not for criticism	.52			0.7
6	Having well equipment and maintenance plan	.51			.07
7	Use of QC tools are to solve the problems	.61			.08
8	Use of Statistical process control for quality improvement	.47			.06
9	Application of PDCA cycle for improvement and process control	.49			.05
10	Use of continuous quality improvement for achieving goal of company	.44			.05
Obtained Fit					
Indices	$\chi^2/df$	RMSEA	IFI	TLI	CFI
Initial	0.905	.000	1.019	1.026	1.000

Since all the fit indices shows the very good result of goodness of fit. All the correlation value of correlation of each item in item

analysis (see table no. 2), are also more than 0.5, which also indicates that the entire item are important for measuring the process control and improvement.

Table 7. CFA of Evaluation and Assessment

Item	Description	Initial		Final	
		MLE	MLE	MLE	Load
1	Regularity of audits of various business strategies	0.58			
2	Regularity of quality audits	0.75	0.77	0.21	
3	Use of Benchmarking	0.77	0.79	0.23	
4	Use of detailed quality related data such as defects rates and scraps	0.79	0.77	0.17	
5	Use of quality related data to evaluate the management	0.62	0.63	0.10	
6	Use of quality related data to evaluate the performance of all departments	0.56			
7	Use of quality related data to evaluate the performance of employees	0.55			
8	Displaying quality related information at the shop floor.	0.69	0.70	0.11	
9	Regularity & update of customer satisfaction survey	0.71	0.68	0.09	
10	Having conduction of measurement scale to measure the performance of employee satisfaction.	0.65	0.66	0.10	
Obtained Fit					
Indices	$\chi^2/df$	RMSEA	IFI	TLI	CFI
Initial	2.201	0.108	.905	.875	.902
Final	1.721	0.084	.967	.950	.967

In initial output, out of ten items item number 6 and 7 have score weight less than or equals to .06 and the score is .075 for the item 1. The correlation of item 6,7 and 1 with average items were

also comparatively low then the other items. So these items have less impact in the constructs. After deleting these constructs the fit indices had shown an improvement, although the RMSEA value is in boarder line. So the remaining seven items were taken for further analysis in the construct evaluation and assessment.

**Table 8. CFA of Employee involvement & empowerment**

Item	Description	Initial			Final	
		MLE	MLE	Load	MLE	Load
1	Having cross-functional teams or quality circles.	0.65	0.72	0.18		
2	Involvement of employees in quality related activities	0.78	0.86	0.4		
3	Implementation of suggestions from employee	0.72	0.65	0.14		
4	Commitment of employees for the success of company	0.55				
5	Condition of encouragement of employees to fix problems	0.56				
6	Reporting work problem is encouraged in company	0.58	0.51	0.09		
7	Employees are taken as valuable resources and encouraged in every activity by top management.	0.54				
<b>Obtained Fit</b>						
Indices	$\chi^2/df$	RMSEA	IFI	TLI	CFI	
Initial	3.255	0.157	.845	.759	.840	
Final	.25	0.000	1.013	1.041	1.000	

The construct employee involvement and empowerment initially has seven items. The initial analysis of correlation of items with its average score also has indicated that the item 4, 5 and 7 has low relationship. While the entire items were kept in CFA, it also has showed this factor has shown the relatively less preference.

The factor score weights for these items 4, 5, and 7 were 0.078, 0.091 and 0.072. The scale should be modified, since all the initial fit indices were below the cutoff ranges. Since as stated in the theory most of the companies of Nepal are in capital intensive and are producing product in cost effective pattern and has given less emphasis on quality development of people. It may be the reason that these score has shown less inclination. So the items 4, 5 and 7 were deleted for further analysis. The scale employee involvement and empowerment has only four items which gives the very fit indices.

Table 9. CFA of Research and Development

Item	Description	Initial		Final	
		MLE	MLE	MLE	Load
1	Identification of customer requirement through market feedback system	0.48	0.51	0.13	
2	Participants of departments in product development process	0.50	0.56	0.19	
3	Review of new product designs before production	0.43	0.32	0.07	
4	Measurement of product value superiority through performance and satisfaction survey.	0.51	0.49	0.15	
5	Use of experimental design in product design process.	0.49	0.53	0.15	
6	Application of Quality Function Deployment (QFD) in product design.	0.36			
Obtained Fit					
Indices	$\chi^2/df$	RMSEA	IFI	TLI	CFI
Initial	3.128	0.144	.732	.494	.696
Final	1.551	0.073	.940	.864	.932

Initially the number of item under research and development has six items. The Item analysis (table 2) reveals that the constructs 6 has relatively low degree of correlation. While keeping

all the items in the CFA, each of the fit indices was below the cutoff range. The factors weight for item 6 was only .06 which is comparatively low with others. In case of Nepal, QFD practices are relatively low than the other tools of quality implementation. After deleting item 6, CFA model gives the better result of goodness of fit. Except TLI (0.864) other values of fit indices gave the higher values than the cutoff value. So ultimately only five item were left for Research and Development constructs of TQM implementation.

Table 10. CFA of Customer Relation

Item	Description	Initial		Final	
		MLE	MLE	MLE	Load
1	Collection of complaint information from customers.	0.57	0.70	0.18	
2	Priority consent on quality-related customer complaints	0.57	0.67	0.15	
3	Conduction and regularity of a customer satisfaction.	0.6	0.65	0.15	
4	Application of market research to collect suggestions for improvement of products.	0.54			
5	Provision of warranty of products.	0.56			
6	Adoption and regularity of customer focused strategy.	0.77	0.58	0.13	
7	Provision of strong after sales service.	0.45			
Obtained Fit					
Indices	$\chi^2/df$	RMSEA	IFI	TLI	CFI
Initial	4.024	0.172	.777	.653	.769
Final	1.551	0.073	.940	.864	.932

Originally there were seven items under customer relation. The correlation analysis of items from table 2 reveals that the items 4, 5 and 7 were less inclination towards the aggregate measure. The correlation values for these items were respectively 0.629, 0.619

and 0.555. The initial CFA measures also indicate the same items have relatively low value. It shows that the most of the companies does not focus on the after sales service as well the warranties and guarantee of the products which they produced. After deleting these items from the CFA, the remaining measures gave the good result in the fit indices. The fit indices with maximum likelihood estimate with factor score weight (load) is exhibited in the above table.

**Table 11. CFA of Education and Training**

Item	Description	Initial		Final	
		MLE	MLE	MLE	Load
1	Encouragement of employee to accept education and training.	0.67	0.65		.16
2	Allocation of resources for employee education and training.	0.59			
3	Training to the employee on how to used quality management methods and tools	0.62	0.65		.12
4	Regarding of employees by management as a valuable resource, so as conduction of education and training throughout their career	0.78	0.80		0.32
5	Interest of employee to attend quality seminar or training programs	0.70	0.74		0.24
Obtained Fit					
Indices	$\chi^2/df$	RMSEA	IFI	TLI	CFI
Initial	2.641	0.127	.946	.888	.944
Final	0.313	.000	1.012	1.039	1.000

Resources are the prime elements for education and training in any organization. The item 2 is the indication of management for the resources for training and education. The construct initially including all five items gave not satisfactory result on  $\chi^2/df$  and RMSEA. Although the correlation table 2 shows the correlation

with aggregate index is 0.722, it is the least correlation among the other items. In the CFA analysis also shows the relative lower value of MLE in the item 2. After deletion of the item 2, the model approaches to significant enhancement level lowering the value of 2 from 13.2 to 0.63. Similarly, the other indices also gave the significantly better results. Since, the industries of Nepal are operating in cost effective pattern and the management may restrict in the allocation of resources for conduction training and education programs. Therefore, research think that the content validity will not affect the analysis by deleting item 2.

## CONCLUSION

The success of any organization depends upon the management strategy on how to implement the competitive tools for quality management. In this competitive era, there is evolution of different quality enhancement tools for total quality management. Unless and until the organization identifies the factors which affect the implementation of TQM and conducts the programs as of the organizational strength, the organization cannot get benefit from it. This study identifies the following nine constructs of TQM implementations with the respective items, which can be implement by the industries of Nepal to get benefit from TQM implementation.

The nine constructs of TQM implementation are Top management commitment & involvement, Policy deployment with process control and improvement, Research and development, training and education, maintaining suppliers' empowerment and relationship, customer relationship, employee empowerment and involvement, and evaluation and assessment.

And the corresponding item of these nine constructs are as follows.



Construct: Top Management commitment and Involvement

Item	Description
1	Encourages employee to involve in quality management and improvement activities.
2	Arrangement of enough resources for education and training.
3	Focuses on product quality rather than yields.
4	Communication and links established with employee
5	Permits employees to solve quality problems.
6	Regularities of top management quality audit

Construct: Policy Deployment

Item	Description
1	Having clear long-term vision statement.
2	The vision effectiveness to encourage employees' commitment.
3	Having clear short term business performance plan.
4	Having a clear quality policy.
5	Having a detailed quality goal.
6	Communication about policies and plans to the employees.
7	Employee's involvement in making policies and plans.

Construct: Supplier's Empowerment

Item	Description
1	Company focus on product quality while selecting suppliers
2	Selection of suppliers on the basis of quality materials.
3	Relationship with suppliers for long term partnership and improvement
4	Recording detailed information about suppliers' performance
5	Conducting regularly suppliers' quality audit

Construct: Process control and improvement

Item	Description
1	Existence of quality steering committee.
2	Availability of clearly stated working instructions
3	Having well-organized and perfect database

- 4 Having plan of inspections effectively in all levels (incoming, process and final product)
- 5 The intend of evaluating employee performance is for improvement not for criticism
- 6 Having well equipment and maintenance plan
- 7 Use of QC tools are to solve the problems
- 8 Use of Statistical process control for quality improvement
- 9 Application of PDCA cycle for improvement and process control
- 10 Use of continuous quality improvement for achieving goal of company

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Construct: Evaluation and Assessment

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Item	Description
1	Regularity of quality audits
2	Use of Benchmarking
3	Use of detailed quality related data such as defects rates and scraps
4	Use of quality related data to evaluate the management
5	Displaying quality related information at the shop floor.
6	Regularity & update of customer satisfaction survey
7	Having conduction of measurement scale to measure the performance of employee satisfaction.

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Construct: Employee involvement & empowerment

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Item	Description
1	Having cross-functional teams or quality circles.
2	Involvement of employees in quality related activities
3	Implementation of suggestions from employee
4	Reporting work problem is encouraged in company

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Construct: Research and Development

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Item	Description
1	Identification of customer requirement through market feedback system
2	Participants of departments in product development process

- 3 Review of new product designs before production
- 4 Measurement of product value superiority through performance and satisfaction survey.
- 5 Use of experimental design in product design process.

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Construct: CFA of Customer Relation

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Item	Description
1	Collection of complaint information from customers.
2	Priority consent on quality-related customer complaints
3	Conduction and regularity of a customer satisfaction.
6	Adoption and regularity of customer focused strategy.

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Construct: Education and Training

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Item	Description
1	Encouragement of employee to accept education and training.
2	Training to the employee on how to used quality management methods and tools
3	Regarding of employees by management as a valuable resource, so as conduction of education and training throughout their career
4	Interest of employee to attend quality seminar or training programs

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